CHAPTER 12. DEPARTURE PROCEDURES

1200. GENERAL. These criteria specify the obstacle clearance requirements to be applied to diverse departures, departure routes, and standard instrument departures (SIDs). Obstacle identification surfaces (OIS) of 40:1 are used. A climb gradient of 200 feet per NM will provide at least 48 feet per NM of clearance above objects which do not penetrate the OIS. Objects which penetrate the OIS are obstacles and shall be considered in the departure procedure by specifying a flight path which will safely avoid the obstacle(s) or by specifying a climb gradient greater than 200 feet per NM that will provide 48 feet of required obstacle clearance (ROC) for each NM of the flight path. Takeoff ceiling and visibility minimums shall be established for those departures specifying a climb gradient.

1201. APPLICATION. Diverse departure criteria (paragraph 1202) shall be applied to all runways authorized by the approving authority for instrument departures. Application of diverse departure criteria may result in the need to develop specific departure routes to avoid obstacles (paragraph 1203).

1202. DIVERSE DEPARTURES. At many airports, a prescribed departure route is not required for ATC purposes nor as the only suitable route to avoid obstacles. In spite of this, there may be obstacles in the vicinity of the airport that should be considered in determining that restrictions to departures are to be prescribed in a given sector(s). The areas and surfaces described herein are to be used to identify such obstacles. Sectors shall be described by bearings and distance from the airport reference point which diverge at least 15° either side of the controlling obstacle. Departure restrictions shall be published as described in paragraph 1207a.

a. Zone 1.

(1) Area. The area begins at the departure end of the runway (DER) and has a beginning width of 1000 feet (± 500 feet from centerline). The area splays 15° on each side of the extended runway centerline for a distance of 2 NM from the DER. See Figure 116A.

(2) Obstacle Identification Surface. A 40:1 OIS overlies Zone 1. It begins no higher than 35 feet above the elevation of the DER and rises in the direction of departure.

b. Zone 2.

(1) Area. Zone 2 extends radially from a point on the runway centerline located 2000 feet from the start end of the runway. It is centered on the extended takeoff surface centerline and excludes Zone 1. It extends the distance necessary for the 40:1 OIS to reach the minimum altitude authorized for en route operations. See Figure 116B.

2. Obstacle Identification Surface. A 40:1 OIS overlies Zone 2 and has a beginning height equal to the height of the OIS at the end of Zone 1. Distance measurements to an obstacle shall be made

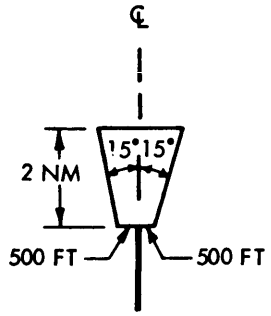

Figure 116A. ZONE 1 DIVERSE DEPARTURE.

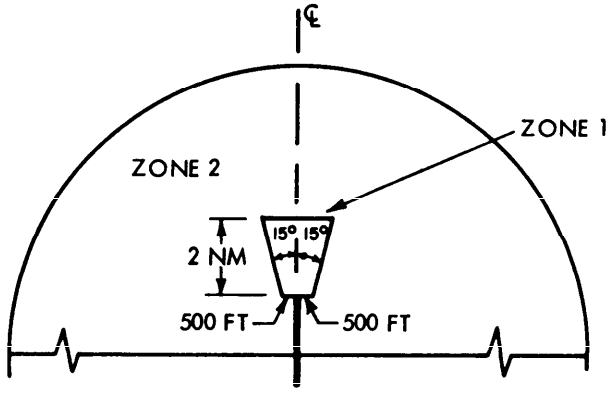

Figure 116B. ZONE 2 DIVERSE DEPARTURE.

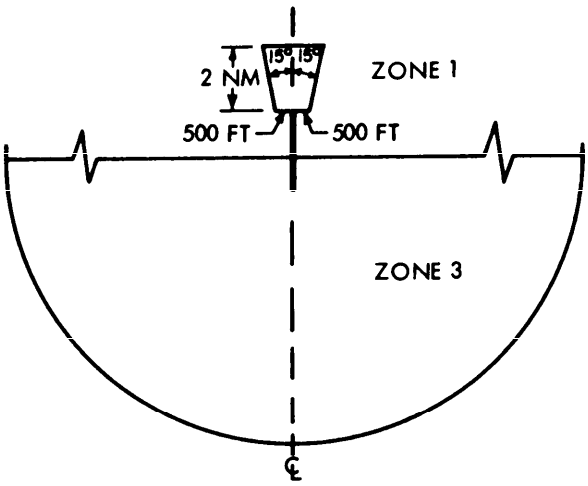

Figure 116C. ZONE 3 DIVERSE DEPARTURE.

from the runway edge or edge of Zone 1, whichever is the shorter distance.

c. Zone 3.

(1) Area. Zone 3 covers the area in the direction opposite to the takeoff, beginning 2000 feet from the start end of the runway. It provides clearance for 180° turn departures and extends the distance necessary for the 40:1 OIS to reach the minimum altitude authorized for en route operations. See Figure 116C.

(2) Obstacle Identification Surface. A 40:1 OIS overlies Zone 3 and begins 400 feet above airport elevation along the runway edge and rises therefrom.

1203. DEPARTURE ROUTES. There are three basic types of departure routes: straight, turning, and combination straight and turning. Departure routes shall be based on positive course guidance acquired within 10 NM from the DER on straight departures and within 5 NM after completion of turns on departures requiring turns. Surveillance radar, when available, may be used to provide positive course guidance.

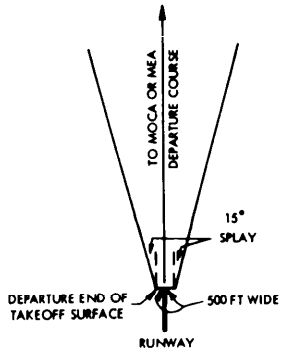

Figure 116D. STRAIGHT DEPARTURE AREA WITHOUT COURSE GUIDANCE.

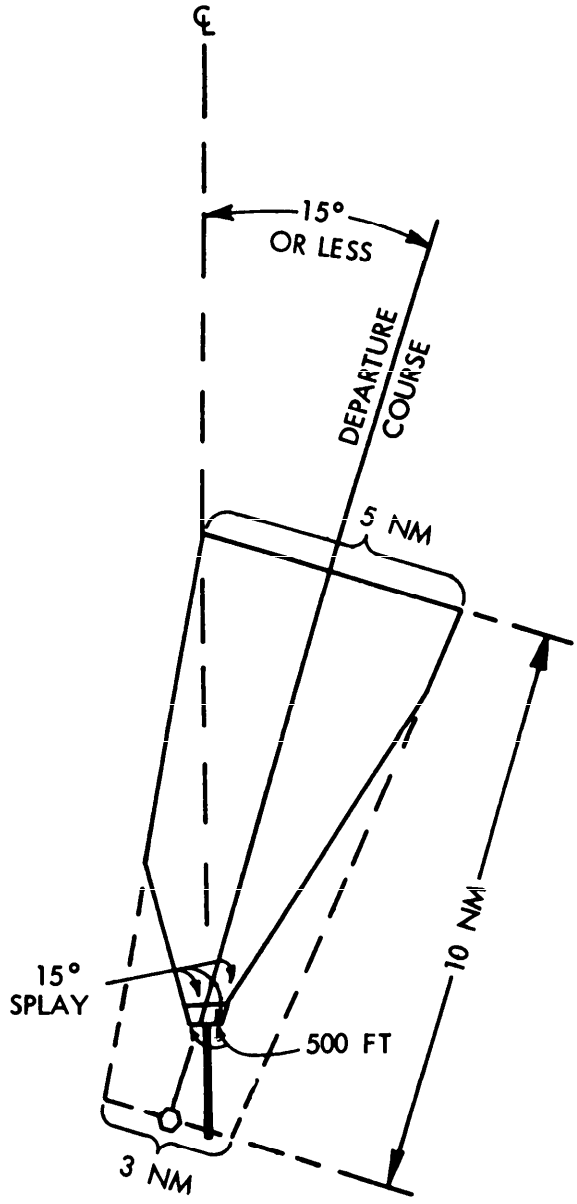

Figure 116E. STRAIGHT DEPARTURE WITH COURSE GUIDANCE FROM ON AIRFIELD FACILITY.

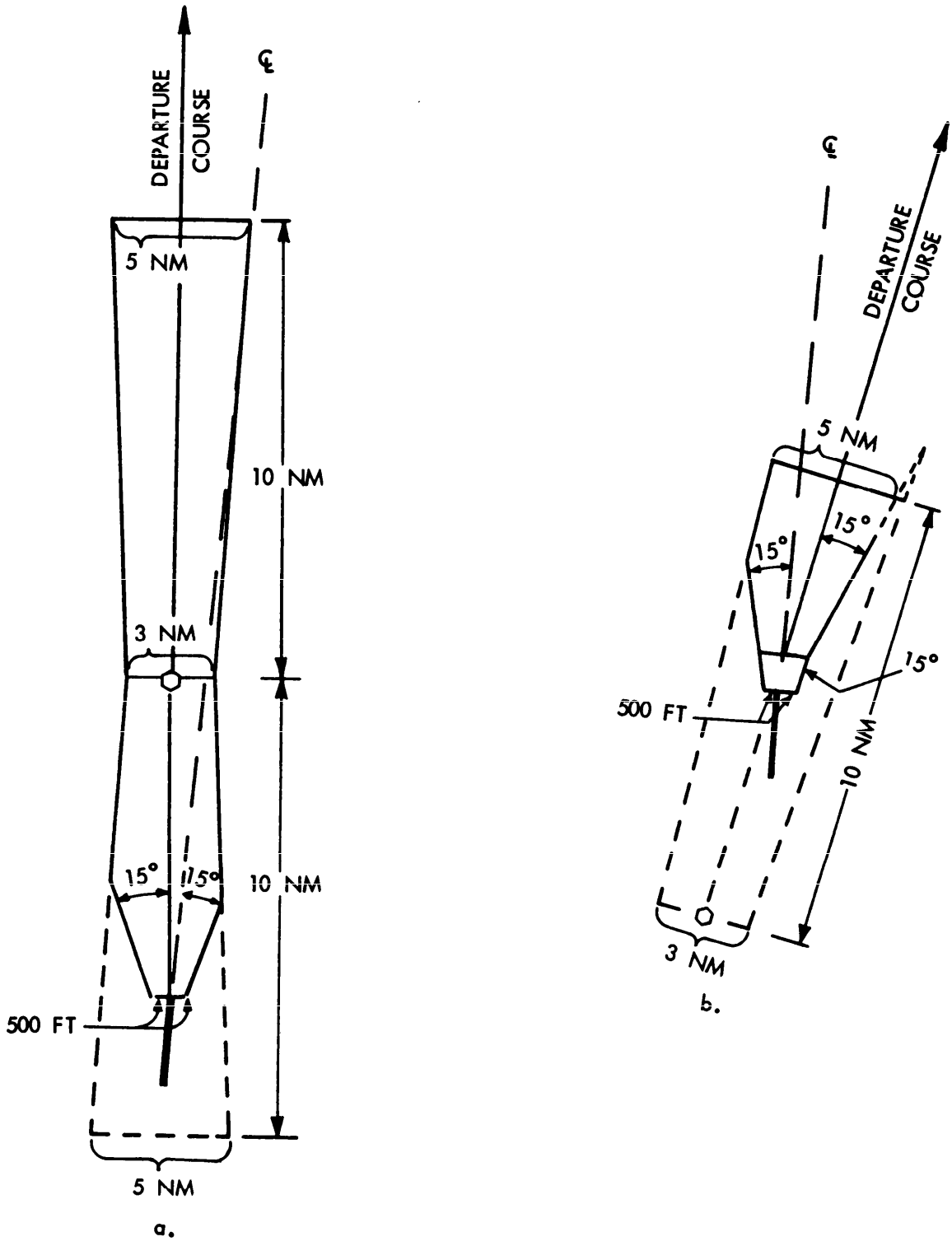

Figure 116F. STRAIGHT DEPARTURE WITH COURSE GUIDANCE FROM ON AIRFIELD FACILITY.

a. Straight Departures. A straight departure is one in which the initial departure course is within 15° of the alignment of the takeoff surface. Additionally, the departure course must intersect the runway centerline extended within 2 NM from the DER or the departure course must lie within 500 feet laterally of the runway centerline at the DER. See Figures 116D, 116E, 116F, 116G, and 116H. When the initial departure course is to a facility, a maneuvering segment is provided under the provisions of paragraph 1203a(1)(b).

(1) Area. The area begins at the departure end of the runway. It is based on the departure course

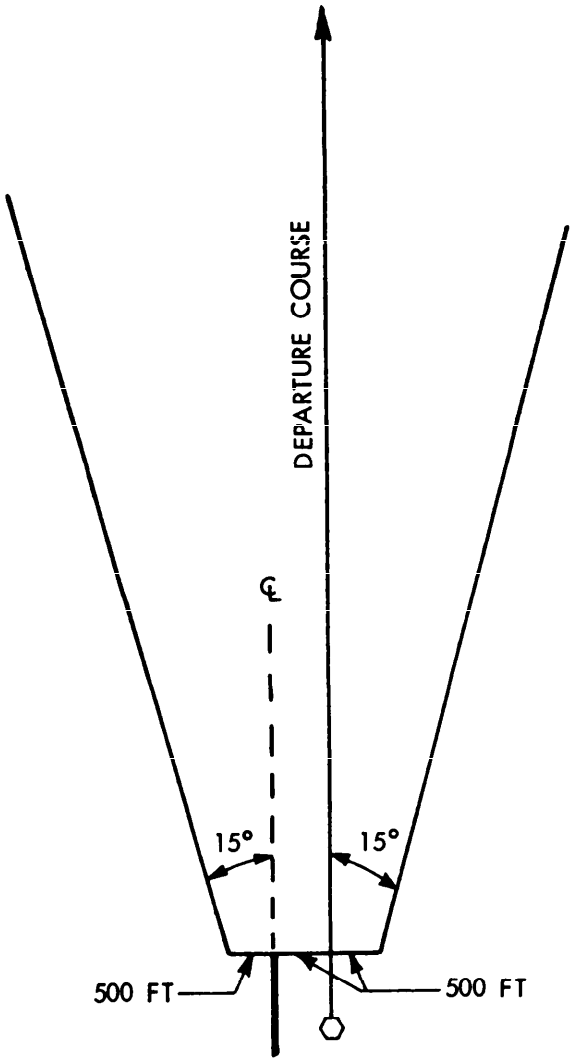

Figure 116G. STRAIGHT DEPARTURE WITH OFFSET DEPARTURE COURSE.

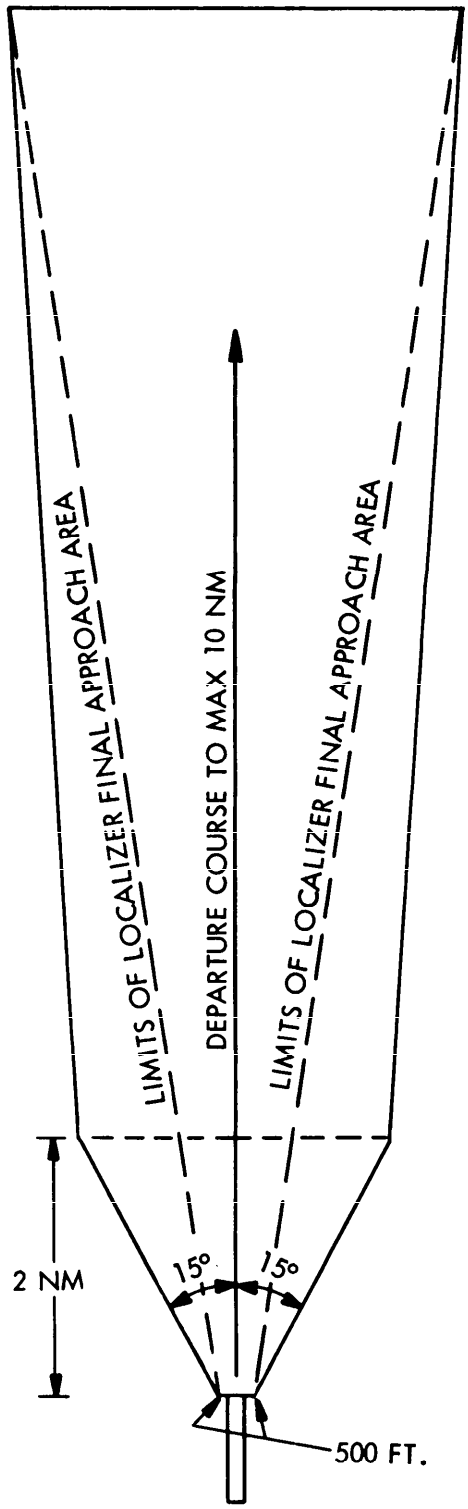

Figure 116H. DEPARTURE AREA WHEN LOCALIZER IS USED FOR COURSE GUIDANCE.

and has a minimum beginning width of 1000 feet (± 500 feet from centerline). The edge of the area shall be no less than 500 feet from the centerline of the runway and the departure course. For example, if the departure course lies 500 feet from the centerline, the beginning width of the area shall be no less than 1500 feet. See Figure 116G. The area splays 15° on each side of the departure course and/or runway centerline extended (whichever protects the greater area) to the point where the boundaries intercept the area associated with the navaid providing course guidance.

(a) When course guidance is provided by a localizer, the area specified in paragraph 1202a(1) shall be used for the first 2 NM of the departure. This area shall be joined to the localizer final approach area stated in paragraph 930b by lines drawn from the extremities of the area at 2 NM from the departure threshold to the width of the localizer area at 10 NM. See Figure 116H. (At certain airports, localizers, although installed, may not be available for use as a departure navaid.)

(b) The area associated with the navaid (other than a localizer) providing course guidance shall have the following dimensions. It shall be 3 NM (± 1 1/2 NM) wide at the facility, it shall have a maximum length of 10 NM and shall splay to a width of 5 NM[1] (± 2 1/2 NM) at 10 NM from the facility. If additional distance is required, the area may be joined from its extremities to the primary en route area using 4.5°[2] of splay until primary en route width is reached.

NOTE 1: 6 NM (± 3 NM) for NDB
NOTE 2: 5° for NDB

(i) If a turn of 15° or less is required over the facility, the inbound and outbound areas outer boundaries shall be joined by an arc of 1 1/2 NM radius.

(ii) If a turn of more than 15° but less than 30° is required over the facility, the turning departure area outer boundary radius (Table 31) shall be applied to join the two areas. The outbound area outer boundary shall be applied to join the two areas. The outbound area outer boundary shall be constructed by a line tangent to the arc and drawn to the edge of the outbound area at 10 NM from the facility. See Figure 116I.

(iii) If a turn of 30° or more is required over the facility, the area shall be extended a distance of 1 NM beyond the facility aligned with the inbound track at a width of 3 NM (± 1 1/2 NM) and the turning departure area outer boundary radius (Table 31) shall be applied to join the extension to the area associated with the outbound track. The outbound area outer boundary shall be constructed by a line tangent to the arc and drawn to the edge of the outbound area at 10 NM from the facility. See Figure 116J.

(2) Obstacle Identification Surface. A 40:1 OIS overlies the straight departure area and rises in the direction of departure. The OIS begins at the DER at an elevation no higher than 35 feet above the elevation of the DER.

b. Turning Departures. If the initial departure course does not meet the criteria specified in paragraph 1203a, a turning departure shall be constructed.

Table 31. Departure Turn Radii

TURN ALTITUDE	FLIGHT TRACK RADIUS NM (R_1)		OUTER BOUNDARY RADIUS NM (R)	
	CATs A & B	OTHERS	CATs A & B	OTHERS*
S.L. to 1000' MSL	1.0	2.5	2.0	5.5
1001' to 3500' MSL	1.2	2.7	2.4	5.9
3501' to 6000' MSL	1.3	2.9	2.6	6.3
6001' to 8500' MSL	1.4	3.1	2.8	6.7
Above 8500' MSL	1.6	3.4	3.2	7.3

**These turn radii will accommodate speeds up to 350 KIAS with 30° angle of bank. Outer boundary radius may be reduced 1/2 NM for operational advantage. Procedure must be annotated with airspeed restriction of 250 KIAS.*

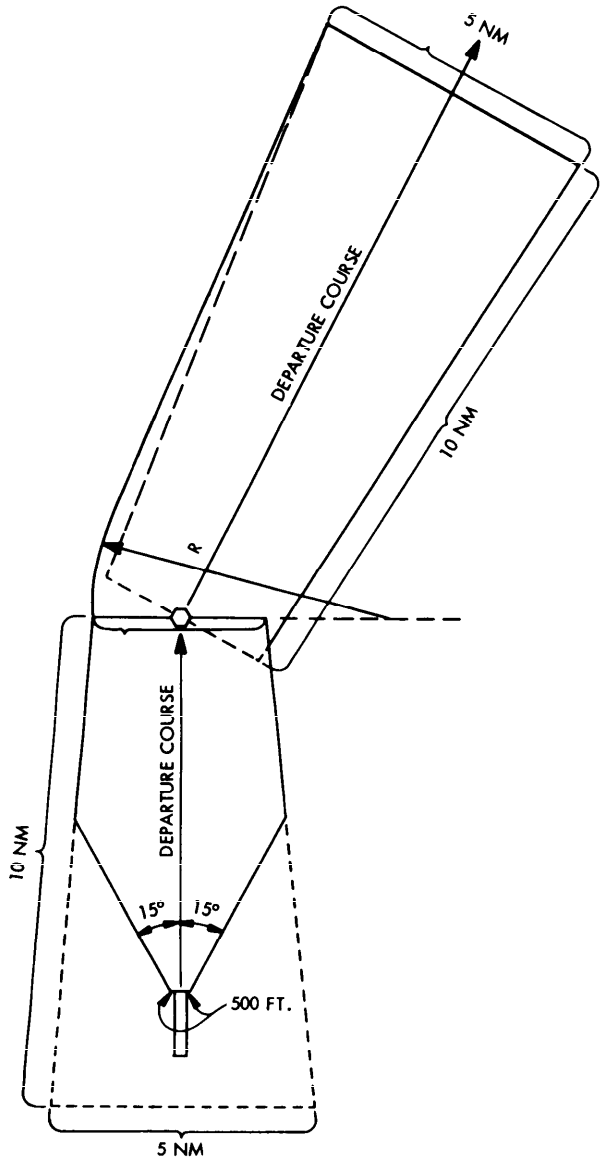

Figure 116I. TURN OF MORE THAN 15° BUT LESS THAN 30° OVER FACILITY.

A turning departure is one in which the aircraft climbs straight ahead on the heading of the takeoff surface until reaching 400 feet above the airport elevation (within 2 NM) and then immediately begins a turn to intercept a departure course. Positive course guidance is required within 5 NM after completion of the turn. See Figure 116K.

(1) Area. The turning departure area is divided into Sections 1 and 2.

(a) Section 1 is identical to the 15° splay area specified in paragraph 1203a(1). It terminates 2 NM from the beginning of the 15° splay area.

(b) Section 2 starts at the end of Section 1. The flight track and outer boundary radii shall be determined from Table 31. The outer boundary line shall splay 15° from the departure course beginning at the point abeam the point where the turn is completed. The inner boundary line shall begin at the runway edge 2000 feet from the start end of the takeoff surface on the side in the direction of the turn (Point D).

It terminates at the same distance abeam the departure course as the outer boundary does at the end of the departure. The splay of Section 2 terminates when the width reaches that of the primary en route structure. Thereafter, en route criteria apply.

(2) Obstacle Identification Surface.

(a) Section 1. A 40:1 OIS overlies Section 1 and is identical to the 40:1 specified in paragraph 1203a(2).

(b) Section 2. The dividing lines between Sections 1 and 2 are identified as "AB, BC, CD." A 40:1 OIS overlies Section 2 and has an initial height equal to the terminating height of Section 1 at any point along the dividing line and rises in the direction of the departure course. The height of the OIS at any point in Section 2 is determined by measuring the straight line distance from this point to the nearest point on the "AB, BC, CD" dividing line.

c. Combination Straight and Turning Departure. If a straight climb to a height which is more than 400 feet above the elevation of the DER is necessary prior to beginning the departure turn, a combination straight and turning departure area must be applied. Whenever possible, the point at which the turn commences shall be identified by a fix or by the intersection of the initial dead reckoning departure course with a radial or bearing which provides positive course guidance. When a fix, radial or bearing is not available, the turn may be specified to commence at an altitude based on a climb gradient of 200 feet per NM. For example, a turn 1000 feet above DER elevation shall be assumed to commence 5 NM from the end of

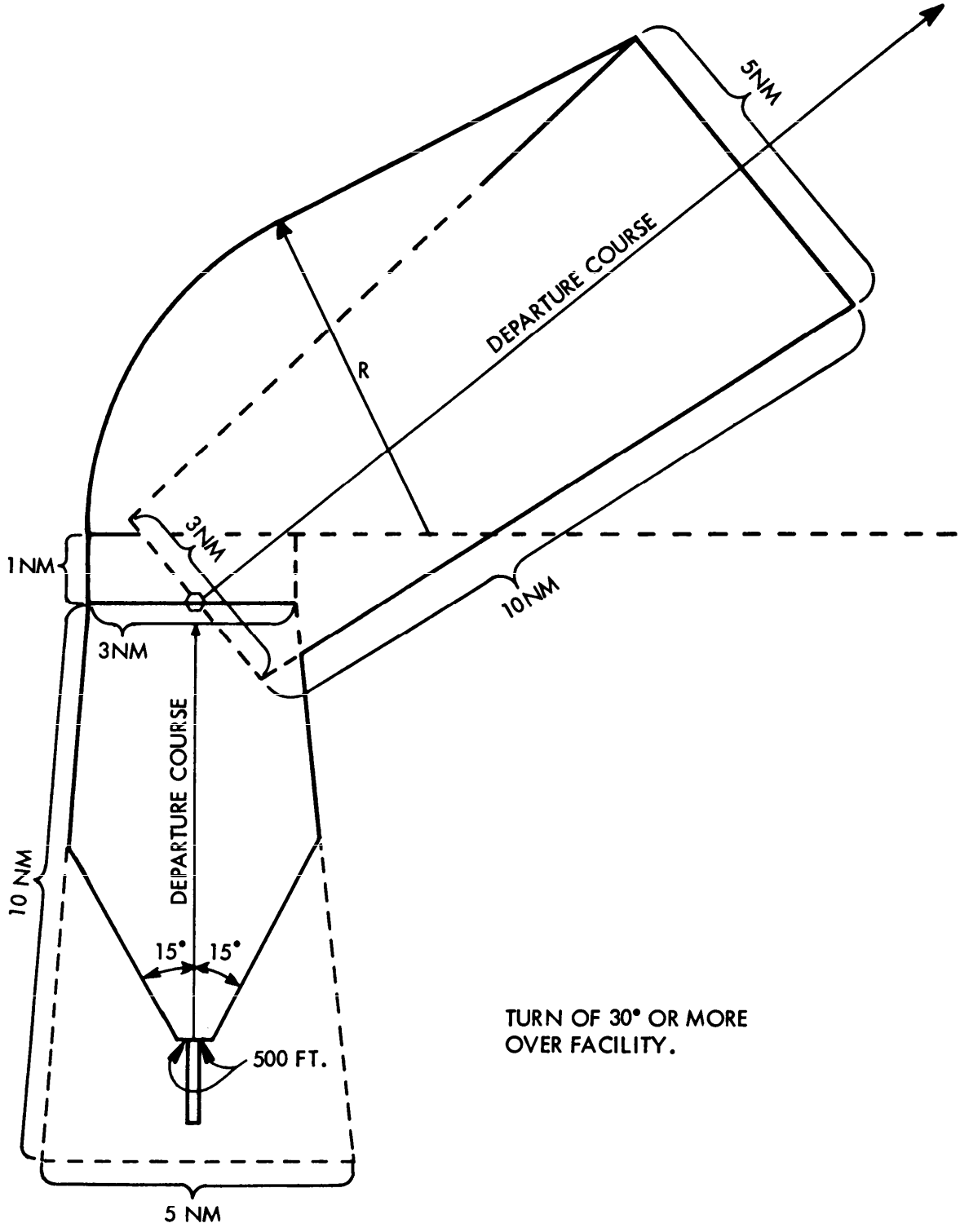

Figure 116J. TURN OF 30° OR MORE OVER FACILITY.

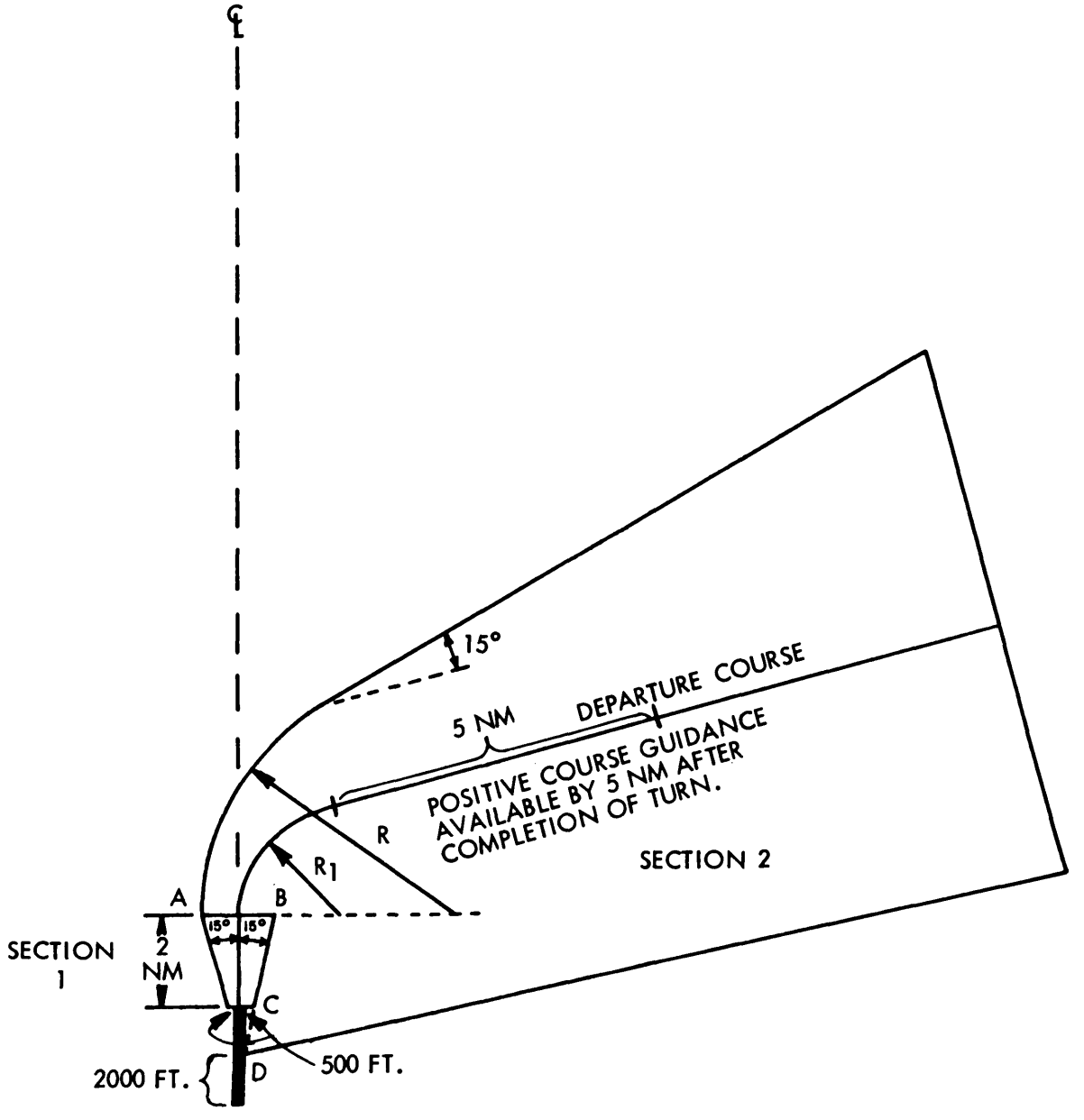

Figure 116K. TURNING DEPARTURE.

runway. Positive course guidance is required within 5 NM after completion of the turn.

(1) Area. The combination straight and turning departure is divided into Sections 1 and 2. See Figure 116L.

(a) Section 1 is identical to the straight departure area except that it extends to the point at which the turn begins.

(b) Section 2 starts at the end of Section 1. The flight track and outer boundary radii shall be determined from Table 31. The outer boundary radius shall be drawn beginning a distance past the plotted position of the turning point equal to the fix error, along track accuracy, or abeam plotted position; whichever is further from the end of the departure runway. The inner boundary line shall begin at the edge of the 15° splay area at a distance prior to the plotted position of the turning point equal to the fix

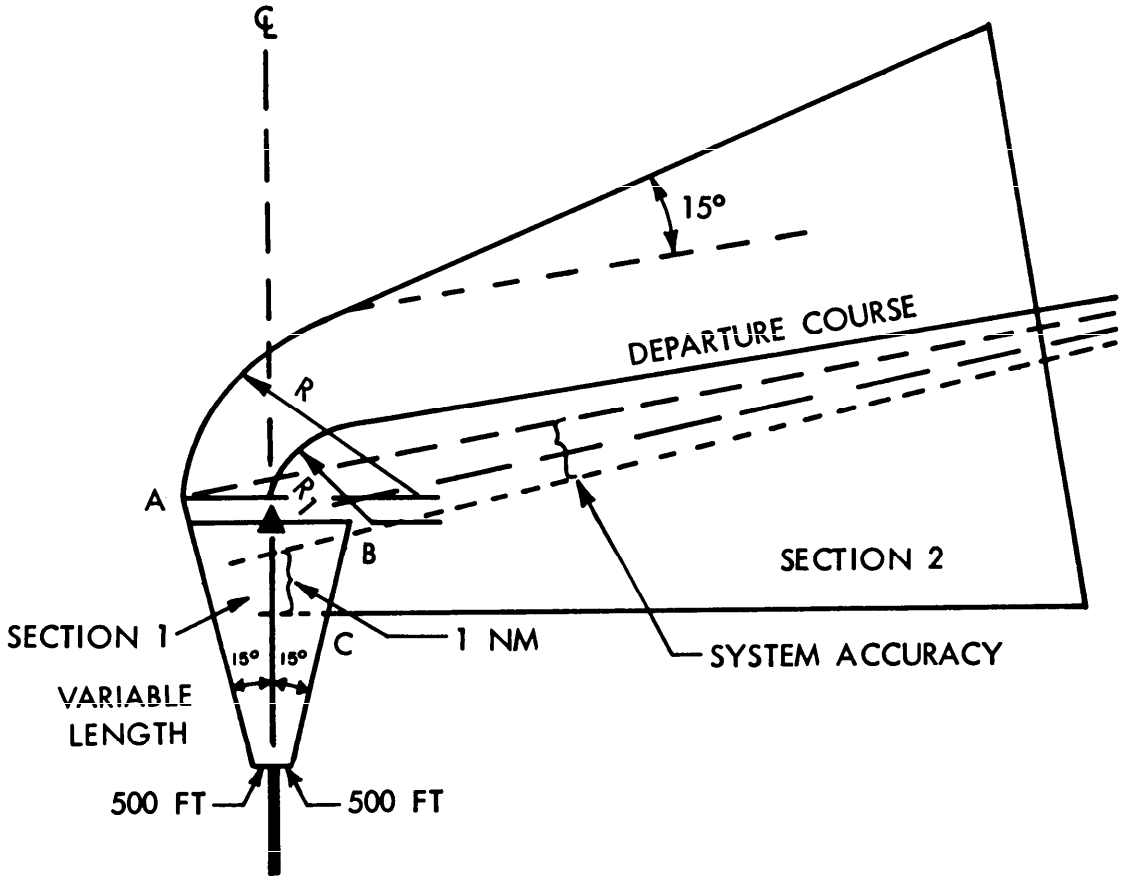

Figure 116L. COMBINATION STRAIGHT AND TURNING DEPARTURE.

error or along track accuracy plot plus 1 NM. Where the turn is specified to commence at an altitude, the outer boundary radius begins at the end of Section 1, and the inner boundary line begins at the edge of the 15° splay area abeam the DER. The outer boundary line shall splay 15 degrees from the departure course beginning at the point abeam the point where the turn is completed. The inner boundary line is drawn from the point of beginning to a point which is the same distance abeam the departure course as the outer boundary is at the end of the departure.

(c) Where a turn is required to intercept a radial/bearing to proceed to or from a facility, alternate area construction is necessary. See Figure 116M. The appropriate flight track radius will join the radial/bearing and the runway centerline extended. The arc will be drawn from a point on the bisector of the angle between the runway centerline extended and the plotted position of the radial/bearing. Section 1 ends at the point of tangency of the extended centerline and the arc. The inner boundary begins at the near edge of Section 1 at a point 1 NM prior to the end of that section. The outer boundary begins at the intersection of the extended 15° splay line of Section 1 and the plotted position of the radial/bearing. The splay of Section 2 terminates when the width reaches that of the primary en route structure. Thereafter, en route width criteria apply.

(2) Obstacle Identification Surface.

(a) Section 1. A 40:1 OIS overlies the straight departure area. It begins no higher than 35 feet above the elevation of the DER and rises in the direction of departure.

(b) Section 2. The dividing lines between Sections 1 and 2 are identified as "AB, BC." A 40:1 OIS overlies Section 2. It has the same height as the Section 1 OIS at the dividing line AB and rises in the direction of the departure course.

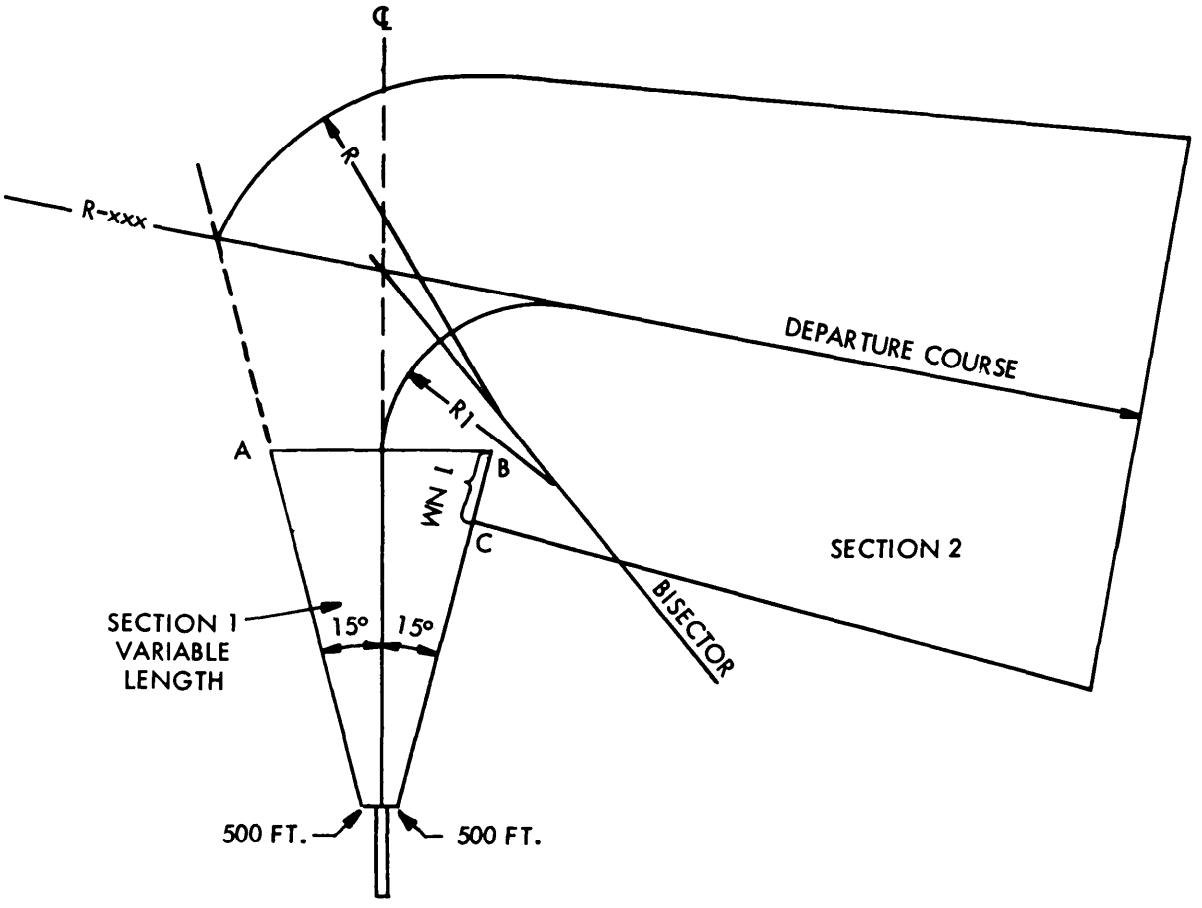

Figure 116M. COMBINATION STRAIGHT AND TURNING DEPARTURE (TO INTERCEPT RADIAL OR BEARING).

1204. EARLY TURNS. Some obstacles, because of location and height (causing excessively high climb gradients), may require a turn as soon as practicable after takeoff (less than 400 feet above airport elevation). Where this condition exists, Zones 1, 2, and 3 of paragraph 1202 (see Figures 116A, 116B, and 116C) shall be used with the following exceptions. The Zone 2 OIS begins at an elevation 50 feet above the elevation of the airport and the Zone 3 OIS (if utilized) begins 200 feet above the elevation of the airport. Measurements in Zones 2 and 3 shall be made to the obstacle from the runway edge. Early turns, when developed, shall be subject to the conditions of paragraph 1207c.

1205. CLIMB GRADIENTS. Climb gradients shall include 48 feet per NM required obstacle clearance. When precipitous terrain is a factor, consideration shall be given to increasing the obstacle clearance (see paragraph 323a). Gradients shall be specified to an altitude or fix at which a gradient of more than 200 feet per NM is no longer required.

a. Diverse Departures. In cases where departure routes are not required to avoid obstacles, but obstacles exist in a sector(s) such as a mountain range, the required gradient shall be computed from the origin of the Zone 2 or 3 OIS (as applicable) direct to the obstacle. The altitude to which the climb gradient must be maintained is based on the obstacle plus ROC requiring the highest altitude in that sector.

b. Departure Routes. Climb gradients shall be computed from the elevation of the OIS at the DER along the shortest possible flight path within the obstacle clearance area to the obstacle.

c. Early Turns. When an early turn is required toward an obstacle in either Zone 2 or 3, the gradient

criteria are applicable to nonprecision approach

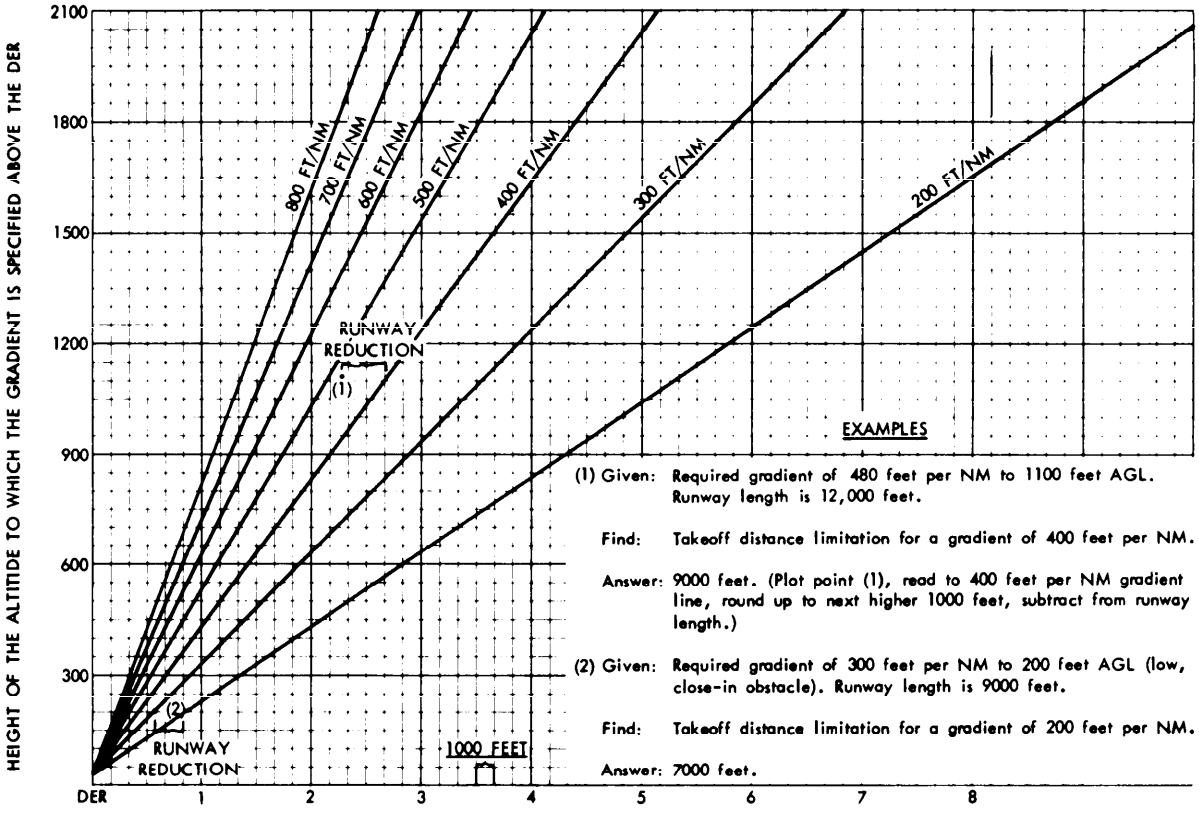

Figure 116N. DISTANCE FROM DER (NM) & RUNWAY REDUCTION (1000'S OF FEET).

will be computed from the origin of the Zone 2 or 3 OIS (as applicable) direct to the obstacle.

d. Climb gradients to 200 feet above DER or less shall not be specified. These gradients would normally be caused by low, close-in obstacles. The provisions of paragraph 1205e should be applied and/or a note published stating that the obstacle(s) exist and should be considered by the pilot.

e. When a climb gradient in excess of 400 feet per NM would be required, a reduction in that gradient for aircraft which use less than the full length of the runway shall be provided. A chart is available to reduce the computed gradient. See Figure 116N.

f. When a climb gradient is specified, it shall be parenthetically stated in climb rate expressed in feet per minute for average ground speeds of 150K, 200K, and additionally at elevations above 5,000 feet MSL at 250K. Example: climb gradient is 300 feet per NM to 3,000 feet MSL (750 feet per minute at 150K, 1,000 feet per minute at 200K).

1206. END OF DEPARTURE. The departure area terminates at a point where the 40:1 OIS, measured along the flight track, reaches the minimum altitude authorized for en route operations or radar vectoring, whichever is applicable.

1207. PUBLISHED INFORMATION. The minimum information to be published for departure procedures is specified as follows:

a. Diverse Departures. Departure restrictions shall be expressed as sectors to be avoided or sectors in which climb gradients and/or minimum altitudes are specified to enable an aircraft to safely overfly an obstacle. When more than one sector is involved, the climb gradient selected shall be the highest in any sector that may be expected to be overflown. The

altitude to which the gradient is specified must permit the aircraft to continue at 200 feet per NM minimum through that sector, a succeeding sector, or to an en route altitude. A fix may also be designated to mark the point at which a climb gradient in excess of 200 feet per NM is no longer required.

b. Departure Routes. A departure route must specify all courses, points, fixes, and altitudes required in the procedure. When obstacles must be overflown, minimum crossing altitudes and climb gradient information shall be provided for all departures requiring a climb gradient greater than 200 feet per NM. The altitude or fix at which a climb gradient in excess of 200 feet per NM is no longer required shall also be specified.

c. Early Turns. The early turn shall be expressed as a turn to a heading or to intercept a course as soon as practicable. When obstacles exist in Zone 1, a minimum ceiling value of 400 feet and a visibility value of at least one mile shall be published. In the event an early turn must be made toward an obstacle within 6 NM of the departure runway, and if no positive course guidance is available, a suitable climb gradient shall be published.

d. The resultant takeoff distance limitation when the provisions of paragraph 1205e are applied.

e. Ceiling and visibility minimums imposed in accordance with paragraph 1208.

f. When departures are limited to Categories A and B aircraft, the procedure shall be clearly annotated.

1208. REQUIRED CEILING AND VISIBILITY MINIMUMS. Procedures requiring a climb gradient in excess of 200 feet per NM shall also specify a ceiling and visibility to be used as an alternative for aircraft incapable of achieving the gradient. The ceiling value shall be the 100-foot increment above the controlling obstacle or above the altitude required over a specified point from which a 40:1 gradient will clear the obstacle. Ceilings of 200 feet or less shall not be specified. The visibility value shall be at least one mile.

1209.–1299. RESERVED.